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Seeds of Compromise: A Proposal and Justification for the Partial Deregulation of Genetically Modified Alfalfa and Sugar Beets

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SEEDS OF COMPROMISE: A PROPOSAL AND JUSTIFICATION FOR THE PARTIAL DEREGULATION OF GENETICALLY MODIFIED ALFALFA AND SUGAR BEETS

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I. INTRODUCTION

Scientific theories and advances consistently have brought forth heated debates amongst scientists, scholars, and members of the community. It is hard to imagine that at one point it was extremely controversial to accept that the Earth was neither flat nor the center of the Universe.[1] Moreover, there is still a great debate between scientists and various members of society concerning Charles Darwin's Theory of Evolution through Natural Selection, which was first published in his book "Origin of Species" over 150 years ago.[2]

As science continues to evolve, and the impossible suddenly becomes the possible, the boundaries of accepted societal norms are thrust into a state of flux. Society is forced to either accept the new scientific theories and technologies or to reject the advances and ultimately determine that Science has once again gone too far.

The introduction of biotechnology and genetically modified organisms (GMOs) and genetically engineered organisms (GEOs) has forced society to once again reevaluate its boundaries and determine the acceptable laws and standards to apply to these scientifically altered organisms.[3] For instance, the introduction of Dolly the Sheep, whose birth marked the first successful cloned mammal from an adult cell, sparked an immediate response from former U.S. President Bill Clinton who

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[1] *See* Brendan O'Neil, *Do They Really Think the Earth is Flat?*, BBC NEWS, (Aug. 4, 2008), http://news.bbc.co.uk/2/hi/7540427.stm; George Sim Johnston, *The Galileo Affair,* CATHOLIC EDUC. RESOURCE CENTER, http://www.catholiceducation.org/articles/history/world/wh0005.html (last visited Jan. 2, 2012).

[2] Charley Dewberry, *A Review of Darwin's* The Origin of Species, MCKENZIE STUDY CENTER, (Mar. 1992), http://www.mckenziestudycenter.org/science/articles/darwin.html (last visited Jan. 2, 2012).

[3] *On this Day, 22 February 1997: Dolly the Sheep is Cloned*, BBC NEWS, http://news.bbc.co.uk/onthisday/hi/dates/stories/february/22/newsid_4245000/4245877.stm (last visited Jan. 2, 2012).

established "a special task force to investigate cloning in order to examine the legal and ethical implications."[4]

Recently, the United States has addressed these issues surrounding genetically modified (GM) plants, such as alfalfa[5] and sugar beets.[6] Currently, federal courts have opposing opinions on the issues surrounding GM crops.[7] The objective of this Note is to evaluate the competing views on GMOs and discuss the direction in which the law should move torward in determining the guidelines of planting and deregulation of the GM crops in lieu of the impact on farmers of conventional, organic, and GM seeds.

This Note will begin by giving a brief history and scientific explanation of GM crops in Part I. Part II will discuss the advantages and disadvantages of GM crops, the competing views on GMOs, and their potential impact on conventional, organic, and pro-GM farmers. Part III will discuss the recent decisions handed down by U.S. federal courts concerning alfalfa and sugar beets and the implications these decisions will have on all farmers. Part IV will discuss the gene flow and risk of contamination between GM and non-GM alfalfa and sugar beets, and Part V of this Note will give an analysis of the gene flow of alfalfa and sugar beets. By examining the case law, gene flow, and economic impact on all farmers, this Note will conclude that the planting of GM crops should not be completely banned from commercial use. Instead, GM crops should be regulated based on research of gene flow and the risk of cross-pollination with non-GM crops of each individual plant species.

II. THE HISTORY OF AGRICULTURAL BIOTECHNOLOGY AND GENETICALLY MODIFIED CROPS

Agricultural biotechnology refers to "a range of tools, including traditional breeding techniques, that alter living organisms, or parts of organisms, to make or modify products; improve plants; or develop microorganisms for specific agricultural uses."[8] Today, agricultural

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[4] *Id.*

[5] *E.g.*, Monsanto Co. v. Geerston Seed Farms, 130 S. Ct. 2743, 2749 (2010).

[6] *E.g.*, Ctr. for Food Safety v. Vilsack, 636 F.3d 1166, 1168 (9th Cir. 2011).

[7] *See Monsanto*, 130 S. Ct. 2743, 2761 (2010) (holding that the injunction issued by the U.S. District Court in Northern California, and affirmed by the U.S. Court of Appeals for the Ninth Circuit, improperly precluded the government from partial deregulation of GM seeds); *see also Ctr. for Food Safety*, 636 F.3d 1166, 1168 (9th Cir. 2011) (holding the district court abused its discretion in issuing a preliminary injunction that prevented the planting and harvesting of GM sugar beets, and that agency permits should be given "full force and effect" because the "plaintiffs failed to demonstrate irreparable harm.").

[8] *Frequently Asked Questions about Biotechnology*, U.S. DEPARTMENT OF AGRIC., http://www.usda.gov/wps/portal/usda (follow "Biotechnology" hyperlink; then follow "Frequently Asked Questions on Biotechnology" hyperlink) (last visited Jan. 2, 2012).

biotechnology, through genetic engineering, allows for specific genes, in unrelated species, to be transferred from one organism to another to get specific, desired traits. Genetic engineering involves the modification of an organism's deoxyribonucleic acid (DNA).[9] This DNA modification alters the "amount or type of proteins an organism is capable of producing," which enables the organism to make new substances or perform new functions.[10]

The first GMOs were developed in 1971.[11] Bio-safety concerns led to the U.S. government to regulate transgenic crop experimentation and research potential environmental risks before allowing the genetically engineered crops to be released in the commercial market.[12] In the 1990s, China became the first country to commercialize transgenic plants by marketing virus-resistant tobacco and tomatoes.[13] In May 1994, the California company Calgene marketed the Flavr-Savr™, a delayed-ripening tomato, which marked the first GM food in the United States.[14] Overall, the use of GM crops has grown exponentially since the 1990s.[15] The use of herbicide-tolerant, (HT), soybeans has increased from 7.4 percent of acres in 1996 to 94 percent in 2011.[16] The use of HT cotton has grown from 2.2 percent of acres in 1996 to 73 percent in 2011, and the use of *Bacillus thuringiensis* insect-resistant (Bt) cotton has grown from 14.6 percent in 1996 to 75 percent in 2011.[17] While the use of Bt corn has increased from 1.4 percent of acres in 1996 to 65 percent in 2011, and the use of HT corn has grown from 3 percent in 1996 to 72 percent in 2011.[18]

Another crop in the United States that is available in GM form is alfalfa. Alfalfa is a multi-billion dollar, perennial crop and is known for its drought, heat, and cold resistance.[19] Monsanto Company (Monsanto) produces Roundup Ready Alfalfa (RRA) amongst other GM seeds, such

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[9] *Id.* at 2.

[10] *Id.*

[11] CLIVE JAMES & ANATOLE F. KRATTIGER, INT'L SERVICE FOR THE ACQUISITION OF AGRI-BIOTECH APPLICATIONS, GLOBAL REVIEW OF THE FIELD TESTING AND COMMERCIALIZATION OF TRANSGENIC PLANTS: 1986 TO 1995: THE FIRST DECADE OF CROP BIOTECHNOLOGY at v (1996), *available at* http://www.isaaa.org/kc/Publications/pdfs/isaaabriefs/Briefs%201.pdf.

[12] *Id.*

[13] *Id.*

[14] *Id.*

[15] *Adoption of Genetically Engineered Crops in the U.S.*, U.S. DEPARTMENT OF AGRIC. ECON. RES. SERVICE, http://www.ers.usda.gov/Data/BiotechCrops (last updated July 1, 2011).

[16] *Adoption of Genetically Engineered Crops in the U.S.: Extent of Adoption*, U.S. DEPARTMENT OF AGRIC. ECON. RES. SERVICE, http://www.ers.usda.gov/Data/BiotechCrops/adoption.htm (last updated July 1, 2011).

[17] *Id.*

[18] *Id.*

[19] ENCYCLOPEDIA BRITANNICA, http://www.britannica.com/EBchecked/topic/14595/alfalfa (last visited Jan. 2, 2012).

as corn and soybeans.[20] The RRA is resistant to glyphosate, which is used as the main active ingredient in Roundup, an herbicide produced by Monsanto.[21] Any alfalfa not genetically altered to be resistant to Roundup would be killed if the herbicide were used on the crop.[22] The idea is that farmers who grow RRA can essentially spray their entire crop with abandon and not have to take the time required to distinguish between troublesome weeds and alfalfa.[23] Essentially, the farmers can quickly spray the herbicide without the fear that they would destroy their own crops. The United States Department of Agriculture (USDA), through the Animal and Plant Health Inspection Service (APHIS), approved the use of GM alfalfa by farmers in 2005 and affirmed its decision in 2011 after completing an Environmental Impact Statement (EIS).[24]

Sugar beets are a biennial major crop within the United States, and they are the source of approximately one-half of the nation's sugar, with the rest of the supply coming from sugar cane plants.[25] In the 2007-2008 growing season, sugar beet farmers sold their crops for about $1.335 billion.[26] Monsanto produces genetically-engineered Roundup Ready sugar beets (RRB), and according to the *New York Times*, 95 percent of all U.S. sugar beet crops are GM and glyphosate-resistant.[27] As with alfalfa, any non-GM sugar beets would be killed if they came into contact with any herbicide, such as Roundup. Since RRB are herbicide resistant, it allows farmers to spray their entire sugar beet crops with herbicide and not have to worry about potentially destroying their crops with the herbicide treatment.

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[20] *Agricultural Seeds*, MONSANTO, http://www.monsanto.com/products/Pages/monsanto-agricultural-seeds.aspx (last visited Jan. 2, 2012).

[21] *Monsanto*, 130 S. Ct. at 2750.

[22] Allen Van Deynze, et al., *Roundup Ready Alfalfa: An Emerging Technology*, AGRIC. BIOTECHNOLOGY IN CALIFORNIA SERIES, (2004), *available at* http://ucanr.org/freepubs/docs/8153.pdf; *see also* Barry Estabrook, *Last Roundup: Monsanto's Genetically Modified Seeds are No Miracle*, ONEARTH, (Aug. 25, 2011), http://www.onearth.org/blog/last-roundup-monsanto-genetically-modified-seeds.

[23] Van Deynze, et al., *supra* note 23 at 1.

[24] *Roundup Ready Alfalfa*, U.S. DEPARTMENT OF AGRIC., ANIMAL AND PLANT HEALTH INSPECTION SERVICE, (Jan. 28, 2011), http://www.aphis.usda.gov/newsroom/hot_issues/alfalfa/index.shtml.

[25] E.g., Andrew Pollack, *Judge Revokes Approval of Modified Sugar Beets*, N.Y. TIMES, (Aug. 13, 2010), *available at* http://www.nytimes.com/2010/08/14/business/14sugar.html?_4=2&scp=1&scp=sugar%20beet&st=cse; *see also About Roundup Ready Sugar Beet*, U.S. DEPARTMENT OF AGRIC., ANIMAL AND PLANT HEALTH INSPECTION SERVICE (Sept. 7, 2010), http://www.aphis.usda.gov/biotechnology/sugarbeet_about.shtml.

[26] Pollack, *supra* note 26.

[27] *Id.*

III. THE ADVANTAGES AND DISADVANTAGES OF BIOTECHNOLOGY AND GM CROPS

Since the development and introduction of GMOs, there has been much discussion and debate concerning the benefits and potential dangers of genetically engineered food. As the world's population continues to increase and the potential consequences of climate change looms, agricultural biotechnology, through the use of GM crops, can help food producers meet the challenges they likely incur in producing sufficient crops to support population growth by reducing costs and making production more manageable.[28] GM crops are engineered to provide several advantages such as insect resistance, disease resistance, herbicide tolerance, cold tolerance, and drought tolerance.[29]

Insect resistant crops are extremely beneficial to farmers. Farmers generally have to apply chemical pesticides to their crops to protect the crops from insect infiltration.[30] Farmers would typically spend a large amount of time and energy applying pesticide treatments to their crops and would still have to deal with subsequent insect damage.[31] However, with the use of insect-resistant crops, farmers who plant these GM seeds no longer struggle with the costly and time-consuming process of spraying their crops with pesticides.[32]

Disease resistant crops are also advantageous to farmers. Viruses, fungi, and bacteria also effect plants and result in many diseases.[33] These plant diseases, as with insects or pests, can devastate crops and result in losses of food production for farmers.[34] Production of GM crops that are resistant to prevalent diseases can increase crop yields and raise returns for farmers, all while reducing the risk of loss of food supply for the consumer.[35]

Herbicide resistant crops provide more efficient weed control, and are therefore easier on food producers. The process of removing weeds through methods such as tilling is both costly and time-consuming.[36] Thus the ability to engineer herbicide resistant crops allows for more efficient weed control.[37] This is seen with crops such as soybeans and corn, in

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[28] *Frequently Asked Questions about Biotechnology*, *supra* note 8.

[29] Deborah B. Whitman, *Genetically Modified Foods: Harmful or Helpful?*, PROQUEST, (Apr. 2000), http://www.csa.com/discoveryguides/gmfood/overview.php.

[30] *Id.*

[31] *See id.*

[32] *Id.*

[33] *Id.*

[34] Whitman, *supra* note 30.

[35] *See Frequently Asked Questions about Biotechnology*, *supra* note 8.

[36] Whitman, *supra* note 30.

[37] *See id.*

addition to the previously mentioned alfalfa and sugar beets, and all of which have been engineered to be resistant to the herbicide Roundup.[38]

Cold and drought tolerance have also shown to be great advantages of GM foods.[39] With climate changes occurring throughout the world, the ability to engineer plants that can withstand greater environmental stresses benefits farmers and helps to maintain, and possibly even increases, the level of food production throughout many countries.[40]

In addition, agricultural biotechnology could possibly reduce allergens in foods, and provide "nutritionally-enriched or longer-lasting" foods, or foods that "contain lower levels of certain naturally occurring toxicants present in some food plants."[41] GM plants are also engineered and developed for phytoremediation, in which the plants purify and absorb pollutants in and out of the soil to enable plants to be harvested and safely disposed.[42]

Despite the many advantages of GM crops, there are some disadvantages that must be considered as well. There is the notion that because biotechnology has introduced GM crops into nature there is no way of knowing the complete long term effects of this introduction, and opponents of GM crops argue that there is no true way to analyze or predict the outcome of GM crops on the environment and other organisms. Many groups, particularly environmental activists and farmers who use conventional or organic seeds, have voiced their concerns about GM crops and the use of agricultural biotechnology.[43] One major concern is the possibility that herbicide and pesticide tolerant GM crops will ultimately reduce the effect of herbicides and pesticides by creating super-weeds and super-pests, which are more resistant to particular herbicides and pesticides.[44]The National Research Council released a report citing the appearance of herbicide-resistant weeds in different regions throughout the United States.[45] The appearance of these super-weeds, which are glyphosate-resistant, would undermine the entire purpose of producing Roundup Ready crops, which are marketed for their ability to withstand the uninhibited spraying of glyphosate, the chemical in Roundup herbicide produced by Monsanto.[46] In areas where these super-weeds are present, nature has shown its ability to adapt to technology, and

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[38] *See id.*

[39] *See id.*

[40] *See id.*

[41] *Frequently Asked Questions about Biotechnology*, *supra* note 8.

[42] *Id.*

[43] *See, e.g.*, Monsanto Co. v. Geerston Seed Farms, 130 S. Ct. 2743, 2743 (2010).

[44] *See* Editorial *Resisting Roundup*, N.Y. TIMES, (May 16, 2010), *available at* http://www.nytimes.com/2010/05/17/opinion/17mon3.html?ref=geneticallymodifiedfood.

[45] *Id.*

[46] *Id.*

thus eventually Roundup will be obsolete, as it will no longer have an effect on these weeds.[47]

Another major concern is that GM crops could cross-pollinate with nearby non-GM plants and eliminate conventional and organic crops.[48] Growers of conventional and organic crops fear that if this cross-pollination occurs, they would no longer be able to market their products as conventional or organic. If farmers are unable to label their products as organic, it reduces the possibility of selling their crops in certain domestic and international markets.[49]

This concern of unintentional gene transfer between non-GM crops and GM crops has led opponents of GM crops to petition the courts to enjoin the planting of GM crops throughout the United States.[50] The debate made its way up to the U.S. Supreme Court, with *Monsanto v. Geerston Seed Farms* marking the first time the U.S. Supreme Court issued a ruling on GM crops.

IV. ANALYSIS OF RECENT FEDERAL CASES CONCERNING GM CROPS

A. Monsanto Co. v. Geerston Seed Farms, 130 S. Ct. 2743 (2010).

In *Monsanto*, the petitioner Monsanto Company, a producer of GM alfalfa seed, RRA, and the U.S. government appealed the judgment of the U.S. Court of Appeals for the Ninth Circuit, which upheld the district court's decision to permanently enjoin the planting of genetically-engineered RRA throughout the nation pending an EIS under the National Environmental Policy Act of 1969 (NEPA).[51]

APHIS, which is a part of the USDA, "has the authority to regulate 'the introduction of organisms and products altered or produced through genetic engineering that are plant pests or are believed to be plant pests,' or 'regulated articles.'"[52] RRA was classified as a "regulated article" by APHIS, and thus, in 2004, Monsanto Company petitioned APHIS to deregulate the RRA.[53] Once an organism is deregulated it is no longer considered to be capable of causing injury or damage to the

[47] *Id.*

[48] *See Monsanto*, 130 S. Ct. 2743, 2754-55 (2010); Ctr. for Food Safety v. Vilsack, 734 F. Supp. 2d 948, 950 (N.D. Cal. 2010).

[49] *See* Geerston Seed Farms v. Johanns, 570 F.3d 1130, 1134 (9th Cir. 2009).

[50] *E.g., Monsanto*, 130 S. Ct. at 2747.

[51] *See id.* at 2746.

[52] *Geerston*, 570 F.3d at 1134 (citing 7 C.F.R. § 340.0(a)(2) & n.1 (1993)).

[53] *Id.* at 1134.

environment.[54] Thus, the planting or use of a deregulated organism no longer needs to be monitored by APHIS.[55] This would allow Monsanto to sell RRA seeds, or any other deregulated GM crop seeds, to any potential buyer who wants to use the seeds in the United States.

Under NEPA, APHIS is required "'to the fullest extent possible' to prepare an [EIS] for 'every recommendation or report on proposals for legislation and other major Federal actio[n] significantly affecting the quality of the human environment.'"[56] However, APHIS is not required to complete an EIS, if after an "environmental assessment" (EA), it finds that the deregulation of RRA will have no significant impact on the environment.[57] Over the objections of conventional and organic alfalfa seed growers, APHIS, through an EA, chose to unconditionally deregulate the RRA finding no significant impact on the environment, and thus not submit an EIS.[58] This allowed for the unregulated planting of RRA throughout the United States.

In *Monsanto*, the U.S. Supreme Court noted that the district court's ruling aimed to remedy the NEPA violation by APHIS in three ways:

> First, it vacated the agency's decision completely deregulating RRA; second, it enjoined APHIS from deregulating RRA, in whole or in apart, pending completion of the mandated EIS; and third, it entered a nationwide injunction prohibiting almost all future planting of RRA. [59]

However, the Court clearly rejected the injunctive approach and reversed the decisions of the Ninth Circuit and the district court.[60] The Court determined that a plaintiff seeking a permanent injunction needs to meet the four-factor test, which is seen in *eBay Inc. v. MercExchange, L.L.C*, by demonstrating that:

> (1) it has suffered an irreparable injury; (2) that remedies available at law, such as monetary damages, are in adequate to compensate for that injury; (3) that,

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[54] *Request for Decision, Glyphosate-Tolerant Alfalfa Events J101 and J163: Request for Nonregulated Status*, ANIMAL AND PLANT HEALTH INSPECTION SERVICE (Jan. 27, 2011), *available at* http://www.aphis.usda.gov/brs/aphisdocs/04_11001p_rod.pdf.

[55] *Id.* at 2.

[56] *Monsanto*, 130 S. Ct. at 2750 (citing 42 U.S.C. § 4332(2)(C) (1970)).

[57] *Id.* at 2750 (citing 40 C.F.R §§ 1508.9(a), 1508.13 (2009)).

[58] *Id.* at 2750.

[59] *Id.* at 2757.

[60] *Id.*

> considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction."[61]

The Court noted that the *eBay* four-factor test applies to plaintiffs seeking permanent injunctions in NEPA violation cases, as determined by the Court in *Winter v. NRDC, Inc.*[62] While the Court noted that the Ninth Circuit and district court took their positions on the injunctive issue before *Winter* was decided, the Court stated that the lower courts direction "inverted the proper mode of analysis."[63] The Court determined that an injunction should only be set in place if the *eBay* test is satisfied.[64]

The Court ultimately determined that the injunction issued by the district court, and upheld by the Ninth Circuit, improperly precluded the government from a partial deregulation of GM seeds and that the injunction eliminated the planting of any RRA.[65] Justice Alito, speaking for the Court, noted, "[i]t is not enough for a court considering a request for injunctive relief to ask whether there is a good reason why an injunction should *not* issue; rather, a court must determine that an injunction *should* issue under the traditional four-factor test set out [in *eBay*]."[66]

Applying the *eBay* injunction test, the Court held none of the factors support the prohibition against the partial deregulation of RRA pending the release of an EIS, because the conventional and organic farmers will not suffer irreparable harm.[67] If APHIS is allowed to proceed with partial deregulation, potential injury will depend on the terms of the deregulation order.[68] The Court analyzed that the injunction issued by the district court is overly broad in that pre-empts APHIS "from pursing *any* deregulation" and the ability to determine what risk, if any, it would pose to the environment.[69]

The Court took the position that with sufficient regulations the conventional and organic farmers' fear of unwanted gene flow would be virtually eliminated and no harm would be imposed on their alfalfa

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[61] *Monsanto*, 130 S. Ct. at 2757 (citing eBay Inc. v. MercExchange, L.L.C, 547 U.S. 388, 391 (2006)).

[62] *Id.* (citing Winter v. NRDC, Inc., 555 U.S. 7, 30-35 (2008).

[63] *Id.* at 2758.

[64] *Id.* at 2757.

[65] *See Id.* at 2759.

[66] *Monsanto*, 130 S. Ct. at 2758.

[67] *Id.* at 2759.

[68] *Id.*

[69] *Id.*

crops.[70] Also, the partial deregulation would be proper as opposed to a complete ban on RRA seed planting.[71] The ruling allowed for APHIS to partially approve the planting of RRA seeds in order for the use of the seeds to continue. On Dec. 16, 2010, the USDA announced that the agency had completed the EIS for RRA and outlined plans for planting the GM crop in 2011.[72]

B. Center for Food Safety v. Vilsack, 734 F. Supp. 2d 948 (N.D. Cal. 2010).

In September 2009, the district court ruled that the USDA and APHIS decision to deregulate genetically engineered sugar beets without preparing an EIS violated NEPA.[73] The Center for Food Safety, on behalf of conventional and organic seed growers, moved to vacate the APHIS decision to deregulate the GM sugar beets or RRB and prevent virtually all future use of the GM sugar beets.[74]

In *Center for Food Safety*, the district court granted the plaintiffs' request to vacate the APHIS decision to deregulate the GM sugar beets.[75] The vacatur re-regulated the GM sugar beets pursuant to the Plant Protection Act (PPA) and enjoined the future planting of all GM sugar beets.[76]

The pro-GM defendants argued the court should not vacate APHIS's decision to deregulate the RRB, because the failure of APHIS to complete an EIS was not "a serious" error.[77] However, the court rejected the defendants' argument stating:

> NEPA is a procedural statute designed to ensure comprehensive consideration of the environmental consequences of agency action. The fact that the court has already found that APHIS failed to fully consider the potential consequences of deregulation and that Plaintiffs have shown that deregulation may significantly affect the environment demonstrates that APHIS's errors are not minor or insignificant.[78]

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[70] *Id.* at 2760.

[71] *Monsanto*, 130 S. Ct. at 2760.

[72] *USDA Environmental Impact Statement on Roundup Ready Alfalfa Completed; Sales Could Resume in Early 2011*, MONSANTO (Dec. 16, 2010), http://www.monsanto.com/newsviews/Pages/USDA-EIS-on-roundup-ready-alfalfa-completed.aspx.

[73] Ctr. for Food Safety v. Vilsack, 734 F. Supp. 2d 948, 950 (N.D. Cal. 2010).

[74] *Id.* at 951.

[75] *Id.* at 955.

[76] *Id.*

[77] *Id.* at 952, 953.

[78] *Vilsack*, 734 F. Supp. 2d at 953.

In *Center for Food Safety*, it was clear the court adamantly disagreed with the defendants on the seriousness of APHIS failing to submit an EIS. The court said:

> APHIS's apparent position that it is merely a matter of time before they reinstate the same deregulation decision, or a modified version of this decision, and thus apparent perception that conducting the requisite comprehensive review is a mere formality, causes some concern that Defendants are no taking this process seriously."[79]

However, the court ultimately denied plaintiffs' request for a permanent injunction, which, if granted, would have prevented the planting of all RRB.[80] Instead, the court determined that the crops planted before the decision were allowed to be harvested by growers.[81] However, future planting of the RRB is restricted to field trials only.[82]

This decision was a major setback for Monsanto and farmers who use RRB seeds because they are no longer allowed to harvest or plant the seeds until government prepares an EIS, which could take several years to complete.[83] Both cases considered the different interests of GM and organic farmers. Unintentional gene transfer has been the root of organic farmers' protest against GM crops, and it is therefore important to analyze whether this concern is warranted and possible methods to prevent cross-pollination.

V. GENE FLOW OF ALFALFA AND SUGAR BEETS

As previously mentioned, the major concern of conventional and organic seed growers is cross-pollination between their non-GM crops and GM crops through gene flow. Gene flow is "the exchange of genes from one population to another."[84] For gene flow to actually occur, the resulting exchange must present a viable seedling, or offspring, of the two organisms.[85] The risk of gene flow amongst specific non-GM and GM crops, such as alfalfa and sugar beets, will help to determine the strategies that should be taken to issue injunctions or orders for deregulation of the

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[79] *Id.*
[80] *Id.* at 955.
[81] *Id.*
[82] *Id.*
[83] Pollack, *supra* note 26.
[84] ALLEN E. VAN DEYNZE, ET AL., COUNCIL FOR AGRIC. SCI. & TECH., Special, GENE FLOW IN ALFALFA: BIOLOGY, MITIGATION, AND POTENTIAL IMPACT ON PRODUCTION 1 (Sept. 2008), *available at* http://sbc.ucdavis.edu/files/CAST%20Alfalfa%20Gene%20Flow157.pdf.
[85] *Id.* at 10.

GM crops. If the risk of gene flow between the crops were determined to be minimal or non-existent, then the cross-pollination fear of conventional and organic farmers would virtually be irrelevant.

A. Alfalfa

Alfalfa appears in nature in three different forms: (1) alfalfa that is used for hay; (2) alfalfa grown for seed production; and (3) feral, or wild, alfalfa plants that grow outside of maintained field crops.[86] Alfalfa is mainly cross-pollinated by cultured leafcutter bees and cultured honeybees, and there is no risk of wind cross-pollination in alfalfa plants.[87] Once the alfalfa is pollinated, it takes approximately four to six weeks, depending upon environmental conditions, for it to develop into viable seed.[88] Feral alfalfa plants can be found along roadsides and fields, and they are usually affected by certain environmental stresses such as drought, insects, and pests.[89] A 2001-2002 survey showed that feral alfalfa plants usually could be found within approximately 2,012 meters from alfalfa crop fields.[90] And if left unmanaged, feral plants have the capability to flower and produce seeds.[91]

Since there are three different forms of alfalfa, there are nine ways for gene flow to occur in alfalfa: (1) hay-to-hay; (2) seed-to-hay; (3) feral-to-hay; (4) hay-to-seed; (5) seed-to-seed; (6) feral-to-seed; (7) hay-to-feral; (8) seed-to-feral; and (9) feral-to-feral.[92] The latter three methods of gene flow that result in genetic transmission to feral alfalfa plants need not be considered in this Note because they usually are not harvested on a commercial level by non-GM or GM growers. Also, the risk of a feral plant being cross-pollinated with GM pollen is minimal because "most seeds formed on a feral plant ... would fail to germinate, compete, or establish outside of cultivation successfully."[93] Therefore, there is little to no probability that a non-GM feral plant could produce GM offspring that would be capable of pollinating a nearby conventional or organic alfalfa plant.

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[86] *Id.* at 5.
[87] *Id.* at 7.
[88] *Id.*
[89] VAN DEYNZE, ET AL., *supra* note 83, at 8.
[90] *Id.*
[91] *Id.* at 9.
[92] *Id.* at 10.
[93] *Id.* at 17.

1. Hay-to-Hay Transfer

For gene flow to occur in hay-to-hay transfer, it must occur in specific ways that each has its own probability of occurrence.[94] The ways gene flow can arise in hay-to-hay transfer are through: flower fertilization, viable seed production, germination; and the production of a plant that is able to contribute to the biomass of the hay crop.[95] Despite the possibility of hay-to-hay transfer, the probability of gene transfer through this method is very low because of the environmental barriers that exist.[96] These environmental barriers include:

> (1) grower practices to harvest alfalfa in a vegetative to early to flower state (before significant flowering) for high-quality forage: (2) scarcity of appropriate pollinators; (3) frequent and complete removal of all above-ground biomass, preventing seed set; and (4) demonstrated inability of the rare seed that is in hay fields actually to germinate, grow, and compete with existing plants to result in a viable plant that contributes to the dry matter of the forage crop.[97]

In hay-to-hay transfer, there is a decreased possibility of gene flow between GM and non-GM alfalfa by harvesting the hay before the seed is produced.[98] "Alfalfa hay normally is harvested at or before first flower, six to nine weeks before the ripe seed state, making hay-to-hay gene flow highly unlikely.[99] Two ways to reduce the likelihood of transfer between GM alfalfa and non-GM alfalfa include harvesting the alfalfa hay prior to flowering and increasing the distance between the GM and non-GM fields, as the risk of gene flow greatly decreases the farther apart the fields are from each other.[100]

2. Seed-to-Hay Transfer

The risk of gene flow through seed-to-hay transfer is determined by the same environmental barriers that are present in hay-to-hay gene flow.[101] In fields harvesting alfalfa seed, the alfalfa will be allowed to

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[94] *Id.* at 10.
[95] VAN DEYNZE, ET AL., *supra* note 83, at 10.
[96] *Id.*
[97] *Id.*
[98] *Id.* at 11.
[99] *Id.*
[100] VAN DEYNZE, ET AL., *supra* note 83, at 11.
[101] *Id.*

flower, thus pollen and pollinators will be present in the fields.[102] If GM seed crops are located near non-GM alfalfa hay crops, the non-GM alfalfa hay farmers could adjust their harvesting schedules to reduce the possibility of gene flow by not allowing their hay to form seeds.[103] In addition, the two crops could increase the distance between the fields to reduce the risk of gene flow.

3. Feral-to-Hay Transfer

Once again, the same environmental barriers that are present in the hay-to-hay gene flow are present in feral-to-hay transfer.[104] As previously mentioned, there is the possibility that feral alfalfa plants could flower; however, feral alfalfa is usually less capable of producing viable flowers, which limits the quality of the pollen from the flowers.[105] Both GM and non-GM alfalfa growers want to reduce the possibility of gene flow from feral alfalfa because of the unknown genetic makeup of the wild alfalfa. In order to reduce gene flow, growers should try to cut down the feral alfalfa that may be located around their crops before it flowers. If this is not possible, the growers should tightly control their harvest to specific times to reduce flowering and pollen production within their individual fields.[106]

4. Hay-to-Seed Transfer

There are several factors that affect hay-to-seed gene flow. These factors include: (1) flowering within the hay field; (2) the flowering duration and the amount of pollen that is produced; (3) pollinators; and (4) the distance between the hay and seed fields.[107] Overall, the risk of gene flow is minimal.[108] Thus, non-GM alfalfa seed growers should not be concerned about gene flow contamination by neighbouring GM hay growers. However, non-GM seed producers should increase the distance between their crops and the GM hay. For instance, there are several ways in which GM seed producers can decrease the risk of gene flow. These include:

> (1) choose to use larger seed fields (e.g., > 5 acres); (2) stock pollinator species that range shorter distances (e.g.,

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[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] VAN DEYNZE, ET AL., *supra* note 83, at 11.
[106] *Id.*
[107] *Id.* at 12.
[108] *Id.*

> leafcutter bees v. others); (3) harvest the seed field border as a separate lot or plant a sexually incompatible species as a border; and (4) work to co-exist with neighbors who grow alfalfa for forage (e.g., ask neighbors to cut their hay early during midsummer or to use non-GE varieties).[109]

5. Seed-to-Seed Transfer

The seed-to-seed gene flow has the highest risk of cross-pollination because there are "fewer environmental barriers limiting gene flow than the other eight scenarios."[110] Thus, gene flow is significantly more probable. However, this form of gene flow is less than 1 percent of all alfalfa interactions.[111] In fields that are harvested for seed, the alfalfa is allowed to pollen, thus there will be an increased number of pollinators throughout these fields.[112] In this situation, growers are accustomed to taking steps to reduce gene flow regardless of whether or not they have GM or non-GM fields. "Seed production scientists and seed companies for decades have promoted using spatial isolation to mitigate gene flow and maintain seed purity."[113]

Pollinators of seed-to-seed gene flow usually are honeybees or leafcutter bees.[114] Research has shown that leafcutter bees and honeybees pollinate neighboring fields and have the highest percent of gene flow at distances under about 610 meters however, there is a significant decrease of gene flow percentage at distances for leafcutter bees at distances up to 1,680 meters, and for honeybees at distances over 3,658 meters.[115] Thus, the research shows that even though seed-to-seed has the highest risk of gene flow between non-GM and GM alfalfa crops, greater distance between the crops would significantly decrease the risk of cross-contamination.

6. Feral-to-Seed Transfer

Feral-to-seed gene flow has several limiting factors such as the ability of a feral plant to produce viable pollen from flowers, the synchrony between the pollen of the feral and commercial seed source, and the "potential for gene flow as a function of gene frequency, isolation

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[109] *Id.*
[110] VAN DEYNZE, ET AL., *supra* note 83, at 13.
[111] *Id.*
[112] *Id.*
[113] *Id.*
[114] *Id.*
[115] VAN DEYNZE, ET AL., *supra* note 83, at 13.

distance, and predominant pollinator species."[116] The clipping of the feral alfalfa plants that surround the alfalfa seed fields can mitigate feral-to-seed gene flow.[117] However, if clipping is not feasible, it is important to remember that the quality of pollen produced from feral alfalfa plants is significantly reduced when compared to the pollen that could be produced from its commercial field counterparts.[118] Thus, the risk of feral-to-seed gene flow is significantly reduced.[119]Moreover, there are several methods that non-GM seed producers can use to reduce the risk of gene flow from feral or other unknown varieties of alfalfa and their seed. These methods are the same as those seen in the hay-to-seed gene flow method.[120]

B. Sugar Beets

Sugar beets reach maturity after two years, and they are usually harvested for sugar within the first year.[121] In the second year of maturation, the sugar beet uses the sugar produced during the first year to make flowers and subsequently seeds.[122] Thus, sugar beets that are harvested purely for sugar never mature long enough to flower or produce seeds.[123]

However, during the planting period for sugar beets, there is the possibility that the sugar beets, both GM and conventional or organic, will "bolt" or flower prematurely within the first year.[124] While this may seem like a significant risk, the number of sugar beets that bolt within a crop is less than 1 per 1,000 square meters of crop field.[125] Once the beets are allowed to flower, or when they bolt, the pollen from the beets has the ability to be carried by the wind or insects up to 1,200 meters.[126] However, most of the pollen produced from the beets does not travel such distances and remains close to the original plants.[127]

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[116] *Id.* at 14.
[117] *Id.*
[118] *Id.*
[119] *Id.* at 15.
[120] VAN DEYNZE, ET AL., *supra* note 83, at 16.
[121] Anastasia Bodnar, *Sugar Beet Biology*, BIOFORTIFIED, (Aug. 25, 2010), http://www.biofortified.org/2010/08/sugar-beet-biology/.
[122] *Id.*
[123] *Id.*
[124] *Id.*
[125] *Id.*
[126] Bodnar, *supra* note 120.
[127] *Id.*

VI. ANALYSIS OF GENE FLOW OF ALFALFA AND SUGAR BEETS

With alfalfa, there are several methods of possible gene flow between the various different forms of the crop. The gene flow method with the greatest risk of contamination is via seed-to-seed, with the possibility of pollination occurring at a distance of approximately 1,680 meters with leafcutter bees and 3,658 meters with honeybees respectively.[128] In addition, there are several environmental barriers that significantly reduce the possibility of gene flow between the forms of alfalfa.[129] With alfalfa, the risk of gene flow can be reduced to insure genetic purity by increased isolation distances in seed production. This can be done by: (1) increasing the distance between non-GM and GM fields; (2) using borders around the different fields; (3) carefully selecting pollination method; and (4) eliminating feral alfalfa plants outside of designated growing areas.[130]

Sugar beets have a lower risk of gene flow contamination between GM and non-GM crops because of the time period in which sugar beets are harvested for sugar.[131] While there is the possibility of the sugar beets flowering prematurely and producing pollen, but the distance of pollination amongst sugar beets is less than one mile or 1,609 meters.[132]

VII. CONCLUSION

While there is a risk of cross-contamination and gene flow between non-GM and GM crops in both alfalfa and sugar beets, the degree of this cross-contamination risk would depend on the gene flow and pollination of that specific crop. However, cross-contamination can be decreased by implementing certain precautionary measures, such as increasing the distance between GM and non-GM crops.

In *Monsanto,* the Court took the most applicable approach by balancing the interest of genetically modified crop growers with those of conventional and organic crop growers by issuing a partial deregulation of RRA. As the Court noted, with sufficient restrictions, the risk of harm due to gene flow between conventional or organic seeds and the RRA would be virtually eliminated.[133] There are several instances in which a partial deregulation of RRA would significantly decrease, if not eliminate, gene flow between the two groups of alfalfa. These examples include isolation

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[128] VAN DEYNZE, ET AL., *supra* note 83, at 13.
[129] *Id.*
[130] *Id.*
[131] Bodnar, *supra* note 120.
[132] *Id.*
[133] Monsanto v. Geerston Seed Farms, 130 S. Ct. 2743, 2760 (2010).

distances between the conventional or organic crops and GM crops, mandating that the GM crops only be grown in remote areas away from the conventional or organic crops, and requiring "buffer zones" of a non-compatible species of that particular plant, which would reduce the risk of gene flow.[134]

As research continues and complete genetic mapping of different plant organisms become available, there will always be proponents and opponents of the resulting GM plants that will be developed. As previously mentioned, there are various advantages and disadvantages to these advances in biotechnology. It is important for courts to consider the risk of gene flow between conventional and GM crops specific to each particular plant species before ordering a complete injunction to enjoin the planting of future GM crops. If the risk of gene flow is minimal, the fears of the non-GM seed farmers are unfounded because contamination would not occur.

In addition, complete injunctions on biotechnology should be avoided. A complete injunction on the farming of GM crops not only limits the use of scientific advances, but it also has grave economic consequences to farmers and potentially to consumers as well. . As mentioned earlier, 95 percent of all sugar beets in the U.S. are GM, and sugar beets make up about 50 percent of all sugar production in this country.[135] With one decision, the district court in *Center for Food Safety* took half of the nation's sugar supply off of the shelves for consumers. The court issued the injunction because of the risk of gene flow despite the fact that the risk of cross contamination between GM and non-GM sugar beets is minimal. Thus there was no need for the revocation of the government's deregulation order. On appeal to the Ninth Circuit, the court determined just that when it held the district court abused its discretion in granting the preliminary injunction, which prevented the planting and harvesting of GM sugar beet crops.[136] The court noted "[b]iology, geography, field experience, and permit restrictions make irreparable injury [to non-GM famers] unlikely."[137]

In all cases such as these concerning GM crops, it is necessary for the court to consider the complete economic ramifications of their decisions. In the above instance concerning GM sugar beets, the best alternative for the district court would have been a partial deregulation of the sugar beets, which could have allowed for the planting of the GM crops in certain designated areas or within a certain distance of non-GM sugar beet crops. Although this would limit the areas in which GM crops

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[134] *Id.*
[135] Pollack, *supra* note 26.
[136] Ctr. for Food Safety v. Vilsack, 636 F.3d 1166, 1174 (9th Cir. 2011).
[137] *Id.*

could be planted, it is a more favorable choice than an injunction preventing planting or an order that would re-regulate GM crops.

As an added safeguard, APHIS should prepare a complete EIS regardless of whether or not it deems the particular GM crop will have a substantial impact on the environment. The EIS should include a gene flow analysis that determines the maximum distance of pollination for the GM crop. This would allow farmers and the courts to determine the distance necessary to reduce, as much as possible, the risk of contamination between the conventional and GM crops.

Within the next few years, there inevitably will be production of more GM farming seeds. Therefore, it is important that opponents and proponents of GM crops reach an agreement and designate specific planting areas, though partial deregulation, for GM and organic crops.